

WHAT IS CLAIMED IS:

1. A head positioning system for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo information,
5 to a target head position on the information recording medium, the head positioning system comprising:

an actuator including a voice coil motor for moving the head;

a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a
10 target head position signal which indicates the target head position, generating a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

a velocity detector for receiving the head position signal, and detecting or estimating a relative velocity of the head with respect to the information recording medium
15 to output a relative velocity signal that indicates a relative velocity of the head;

a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

20 an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal; and

an estimation controller for outputting a velocity control signal based on the corrected estimated velocity signal,

25 wherein the actuator is controlled by a control amount signal that is

obtained by adding together at least the position control signal and the velocity control signal.

2. The head positioning system of claim 1, wherein:

5 the estimation controller estimates an external disturbance based on the corrected estimated velocity signal and the control amount signal to output a force disturbance control signal; and

 the control amount signal is obtained by adding together the force disturbance control signal, the velocity control signal and the position control signal.

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3. The head positioning system of claim 2, wherein:

 the velocity detector assumes that the disturbance is represented by a stepped waveform and estimates the disturbance based on the head position signal and the control amount signal to output an estimated disturbance signal; and

15 the estimation controller generates the force disturbance control signal based on the estimated disturbance signal.

4. The head positioning system of claim 2, wherein:

 the position control signal is a discrete signal; and

20 the velocity control signal and the force disturbance control signal are continuous signals which vary during the time when the position control signal takes a constant value or discrete signals whose frequencies are higher than that of the position control signal.

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5. The head positioning system of claim 1, wherein:

the velocity detector and the counter electromotive voltage detector output the relative velocity signal and the estimated head velocity signal, respectively, at periodic or non-periodic intervals; and

5 the estimated velocity corrector corrects an estimation error of the estimated head velocity signal from the counter electromotive voltage detector based on an average of the difference or ratio between n samples of the relative velocity signal which are detected by the velocity detector and n samples of the estimated head velocity signal which are detected by the counter electromotive voltage detector (where n is a natural number).

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6. The head positioning system of claim 1, wherein:

the estimated velocity corrector makes a correction to an estimation error of the estimated head velocity signal at a predetermined cycle;

15 in a cycle where the relative velocity signal is input, the estimated velocity corrector calculates a new correction amount to make a correction to the estimation error; and

in a cycle where the relative velocity signal is not input, the estimated velocity corrector uses a previous correction amount to make a correction to the estimation error.

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7. The head positioning system of claim 6, wherein:

the velocity detector detects or estimates the velocity of the head at a predetermined sampling cycle; and

25 the estimated velocity corrector corrects an estimation error of the estimated head velocity signal at a cycle equal to or shorter than a 1/2 of the sampling cycle.

8. The head positioning system of claim 1, wherein:

the counter electromotive voltage detector has an analog-digital converter whose dynamic range is freely switchable or a plurality of analog-digital converters having
5 different dynamic ranges; and

the counter electromotive voltage detector switches the dynamic range according to a control operation mode of the head.

9. A head positioning system for positioning a head, which at least reads information from
10 a rotating disk-shaped information recording medium containing at least servo information, to a target head position on the information recording medium, the head positioning system comprising:

an actuator including a voice coil motor for moving the head;

a position controller for receiving a head position signal which is generated
15 by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, generating a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

a velocity detector for receiving the head position signal, detecting a relative
20 velocity of the head with respect to the information recording medium, and estimating the relative head velocity to output a detected velocity signal that indicates a detected value of the relative head velocity and an estimated velocity signal that indicates an estimated value of the relative head velocity;

a velocity signal switch for receiving the detected velocity signal and the
25 estimated velocity signal and selectively outputting any one of the detected velocity signal

and the estimated velocity signal as a relative velocity signal;

a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an
5 estimated head velocity signal;

an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal; and

an estimation controller for outputting a velocity control signal based on the
10 corrected estimated velocity signal,

wherein the actuator is controlled by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

15 10. The head positioning system of claim 9, wherein:

the estimation controller estimates an external disturbance based on the corrected estimated velocity signal and the control amount signal to output a force disturbance control signal; and

the control amount signal is obtained by adding together the force
20 disturbance control signal, the velocity control signal and the position control signal.

11. The head positioning system of claim 10, wherein:

the velocity detector assumes that the disturbance is represented by a stepped waveform and estimates the disturbance based on the head position signal and the
25 control amount signal to output an estimated disturbance signal; and

the estimation controller generates the force disturbance control signal based on the estimated disturbance signal.

12. The head positioning system of claim 10, wherein:

5 the position control signal is a discrete signal; and
 the velocity control signal and the force disturbance control signal are continuous signals which vary during the time when the position control signal takes a constant value or discrete signals whose frequencies are higher than that of the position control signal.

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13. The head positioning system of claim 9, wherein:

 the velocity detector and the counter electromotive voltage detector output the relative velocity signal and the estimated head velocity signal, respectively, at periodic or non-periodic intervals; and

15 the estimated velocity corrector corrects an estimation error of the estimated head velocity signal from the counter electromotive voltage detector based on an average of the difference or ratio between n samples of the relative velocity signal which are detected by the velocity detector and n samples of the estimated head velocity signal which are detected by the counter electromotive voltage detector (where n is a natural number).

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14. The head positioning system of claim 9, wherein:

 the estimated velocity corrector makes a correction to an estimation error of the estimated head velocity signal at a predetermined cycle;

 in a cycle where the relative velocity signal is input, the estimated velocity
25 corrector calculates a new correction amount to make a correction to the estimation error;

and

in a cycle where the relative velocity signal is not input, the estimated velocity corrector uses a previous correction amount to make a correction to the estimation error.

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15. The head positioning system of claim 14, wherein:

the velocity detector detects or estimates the velocity of the head at a predetermined sampling cycle; and

the estimated velocity corrector corrects an estimation error of the estimated head velocity signal at a cycle equal to or shorter than a 1/2 of the sampling cycle.

16. The head positioning system of claim 9, wherein:

the counter electromotive voltage detector has an analog-digital converter whose dynamic range is freely switchable or a plurality of analog-digital converters having different dynamic ranges; and

the counter electromotive voltage detector switches the dynamic range according to a control operation mode of the head.

17. A head positioning system for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo information, to a target head position on the information recording medium, the head positioning system comprising:

an actuator including a voice coil motor for moving the head;

a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a

target head position signal which indicates the target head position, generating a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

5 a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal, and estimating the position of the head by integrating the estimated head velocity signal to output an estimated head position signal;

10 an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on a difference between the head position signal and the estimated head position signal to output a corrected estimated velocity signal; and

an estimation controller for outputting a velocity control signal based on the corrected estimated velocity signal,

15 wherein the actuator is controlled by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

18. The head positioning system of claim 17, wherein:

20 the estimation controller estimates an external disturbance based on the corrected estimated velocity signal and the control amount signal to output a force disturbance control signal; and

the control amount signal is obtained by adding together the force disturbance control signal, the velocity control signal and the position control signal.

19. The head positioning system of claim 18, wherein:

the velocity detector assumes that the disturbance is represented by a stepped waveform and estimates the disturbance based on the head position signal and the control amount signal to output an estimated disturbance signal; and

5 the estimation controller generates the force disturbance control signal based on the estimated disturbance signal.

20. The head positioning system of claim 18, wherein:

the position control signal is a discrete signal; and

10 the velocity control signal and the force disturbance control signal are continuous signals which vary during the time when the position control signal takes a constant value or discrete signals whose frequencies are higher than that of the position control signal.

15 21. The head positioning system of claim 17, wherein:

the counter electromotive voltage detector outputs the estimated head velocity signal at periodic or non-periodic intervals; and

the estimated velocity corrector corrects an estimation error of the estimated head velocity signal from the counter electromotive voltage detector based on an average
20 of the difference or ratio between n samples of the head position signal and n samples of the estimated head position signal which are detected by the counter electromotive voltage detector (where n is a natural number).

22. The head positioning system of claim 17, wherein:

25 the estimated velocity corrector makes a correction to an estimation error of

the estimated head velocity signal at a predetermined cycle;

in a cycle where the head position signal is input, the estimated velocity corrector calculates a new correction amount to make a correction to the estimation error; and

5 in a cycle where the head position signal is not input, the estimated velocity corrector uses a previous correction amount to make a correction to the estimation error.

23. The head positioning system of claim 22, wherein:

the velocity detector detects or estimates the velocity of the head at a
10 predetermined sampling cycle; and

the estimated velocity corrector corrects an estimation error of the estimated head velocity signal at a cycle equal to or shorter than a 1/2 of the sampling cycle.

24. The head positioning system of claim 17, wherein:

15 the counter electromotive voltage detector has an analog-digital converter whose dynamic range is freely switchable or a plurality of analog-digital converters having different dynamic ranges; and

the counter electromotive voltage detector switches the dynamic range according to a control operation mode of the head.

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25. A head positioning system for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo information, to a target head position on the information recording medium, the head positioning system comprising:

25 an actuator including a voice coil motor for moving the head;

a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, generating a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

a velocity detector for receiving the head position signal, and detecting or estimating a relative velocity of the head with respect to the information recording medium to output a relative velocity signal that indicates a relative velocity of the head;

a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal;

an estimated velocity signal switch for receiving the estimated head velocity signal and the corrected estimated velocity signal, and selectively outputting any one of the estimated head velocity signal and the corrected estimated velocity signal as a velocity signal; and

an estimation controller for outputting a velocity control signal based on the velocity signal from the estimated velocity signal switch,

wherein the actuator is controlled by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

26. The head positioning system of claim 25, wherein:

the estimation controller estimates an external disturbance based on the control amount signal and the velocity signal from the estimated velocity signal switch to output a force disturbance control signal; and

5 the control amount signal is obtained by adding together the force disturbance control signal, the velocity control signal and the position control signal.

27. The head positioning system of claim 26, wherein:

10 the velocity detector assumes that the disturbance is represented by a stepped waveform and estimates the disturbance based on the head position signal and the control amount signal to output an estimated disturbance signal; and

the estimation controller generates the force disturbance control signal based on the estimated disturbance signal.

15 28. The head positioning system of claim 26, wherein:

the position control signal is a discrete signal; and

the velocity control signal and the force disturbance control signal are continuous signals which vary during the time when the position control signal takes a constant value or discrete signals whose frequencies are higher than that of the position control signal.

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29. The head positioning system of claim 25, wherein:

the velocity detector and the counter electromotive voltage detector output the relative velocity signal and the estimated head velocity signal, respectively, at periodic or non-periodic intervals; and

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the estimated velocity corrector corrects an estimation error of the estimated head velocity signal from the counter electromotive voltage detector based on an average of the difference or ratio between n samples of the relative velocity signal which are detected by the velocity detector and n samples of the estimated head velocity signal which are detected by the counter electromotive voltage detector (where n is a natural number).

30. The head positioning system of claim 25, wherein:

the estimated velocity corrector makes a correction to an estimation error of the estimated head velocity signal at a predetermined cycle;

10 in a cycle where the relative velocity signal is input, the estimated velocity corrector calculates a new correction amount to make a correction to the estimation error; and

in a cycle where the relative velocity signal is not input, the estimated velocity corrector uses a previous correction amount to make a correction to the estimation error.

31. The head positioning system of claim 30, wherein:

the velocity detector detects or estimates the velocity of the head at a predetermined sampling cycle; and

20 the estimated velocity corrector corrects an estimation error of the estimated head velocity signal at a cycle equal to or shorter than a 1/2 of the sampling cycle.

32. The head positioning system of claim 25, wherein:

the counter electromotive voltage detector has an analog-digital converter whose dynamic range is freely switchable or a plurality of analog-digital converters having

different dynamic ranges; and

the counter electromotive voltage detector switches the dynamic range according to a control operation mode of the head.

5 33. A head positioning system for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo information, to a target head position on the information recording medium, the head positioning system comprising:

an actuator including a voice coil motor for moving the head;

10 a velocity detector for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head, and detecting or estimating a relative velocity of the head with respect to the information recording medium to output a relative velocity signal that indicates a relative velocity of the head;

15 a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal, and estimating the position of the head by integrating the estimated head velocity signal to output an estimated head position signal;

20 an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal;

an estimated position corrector for correcting an estimation error of the estimated head position signal based on a difference between the head position signal and
25 the estimated head position signal to output a corrected estimated head position signal; and

an estimation controller for generating a position control signal and a velocity control signal based on the corrected estimated velocity signal and the corrected estimated head position signal,

wherein the actuator is controlled by a control amount signal that is
5 obtained by adding together at least the position control signal and the velocity control signal.

34. The head positioning system of claim 33, wherein:

the estimation controller estimates an external disturbance based on the
10 corrected estimated velocity signal and the control amount signal to output a force disturbance control signal; and

the control amount signal is obtained by adding together the force disturbance control signal, the velocity control signal and the position control signal.

15 35. The head positioning system of claim 34, wherein:

the velocity detector assumes that the disturbance is represented by a stepped waveform and estimates the disturbance based on the head position signal and the control amount signal to output an estimated disturbance signal; and

the estimation controller generates the force disturbance control signal
20 based on the estimated disturbance signal.

36. The head positioning system of claim 34, wherein:

the position control signal is a discrete signal; and

the velocity control signal and the force disturbance control signal are
25 continuous signals which vary during the time when the position control signal takes a

constant value or discrete signals whose frequencies are higher than that of the position control signal.

37. The head positioning system of claim 33, wherein:

5 the velocity detector and the counter electromotive voltage detector output the relative velocity signal and the estimated head velocity signal, respectively, at periodic or non-periodic intervals; and

 the estimated velocity corrector corrects an estimation error of the estimated head velocity signal from the counter electromotive voltage detector based on an average
10 of the difference or ratio between n samples of the relative velocity signal which are detected by the velocity detector and n samples of the estimated head velocity signal which are detected by the counter electromotive voltage detector (where n is a natural number).

38. The head positioning system of claim 33, wherein:

15 the estimated velocity corrector makes a correction to an estimation error of the estimated head velocity signal at a predetermined cycle;

 in a cycle where the relative velocity signal is input, the estimated velocity corrector calculates a new correction amount to make a correction to the estimation error; and

20 in a cycle where the relative velocity signal is not input, the estimated velocity corrector uses a previous correction amount to make a correction to the estimation error.

39. The head positioning system of claim 38, wherein:

25 the velocity detector detects or estimates the velocity of the head at a

predetermined sampling cycle; and

the estimated velocity corrector corrects an estimation error of the estimated head velocity signal at a cycle equal to or shorter than a 1/2 of the sampling cycle.

5 40. The head positioning system of claim 33, wherein:

the counter electromotive voltage detector has an analog-digital converter whose dynamic range is freely switchable or a plurality of analog-digital converters having different dynamic ranges; and

the counter electromotive voltage detector switches the dynamic range
10 according to a control operation mode of the head.

41. A head positioning system for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo information, to a target head position on the information recording medium, the head
15 positioning system comprising:

an actuator including a voice coil motor for moving the head;

a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, generating a position
20 error signal that is a difference between the head position signal and the target head position signal, outputting a position control signal based on the position error signal, and outputting a position error integration control signal obtained by integrating the position error signal;

a velocity detector for receiving the head position signal, and detecting or
25 estimating a relative velocity of the head with respect to the information recording medium

to output a relative velocity signal that indicates a relative velocity of the head;

5 a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

 an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal; and

10 an estimation controller for outputting a velocity control signal based on the corrected estimated velocity signal,

 wherein the actuator is controlled by a control amount signal that is obtained by adding together the position control signal, the position error integration control signal and the velocity control signal.

15 42. A disk drive apparatus comprising:

 a disk-shaped information recording medium containing at least servo information;

 a rotation control mechanism for rotating the information recording medium;

20 a head for at least reading information from the information recording medium; and

 a head positioning system for positioning the head to a target head position on the information recording medium,

 wherein the head positioning system includes:

25 an actuator including a voice coil motor for moving the head;

a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, generating a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

a velocity detector for receiving the head position signal, and detecting or estimating a relative velocity of the head with respect to the information recording medium to output a relative velocity signal that indicates a relative velocity of the head;

a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal; and

an estimation controller for outputting a velocity control signal based on the corrected estimated velocity signal,

wherein the actuator is controlled by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

43. A disk drive apparatus comprising:

a disk-shaped information recording medium containing at least servo

information;

a rotation control mechanism for rotating the information recording medium;

5 a head for at least reading information from the information recording medium; and

a head positioning system for positioning the head to a target head position on the information recording medium,

wherein the head positioning system includes:

an actuator including a voice coil motor for moving the head;

10 a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, generating a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error
15 signal;

a velocity detector for receiving the head position signal, detecting a relative velocity of the head with respect to the information recording medium, and estimating the relative head velocity to output a detected velocity signal that indicates a detected value of the relative head velocity and an estimated velocity signal that indicates
20 an estimated value of the relative head velocity;

a velocity signal switch for receiving the detected velocity signal and the estimated velocity signal and selectively outputting any one of the detected velocity signal and the estimated velocity signal as a relative velocity signal;

a counter electromotive voltage detector for detecting a counter
25 electromotive voltage signal of the voice coil motor of the actuator, and estimating an

absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a
5 corrected estimated velocity signal; and

an estimation controller for outputting a velocity control signal based on the corrected estimated velocity signal,

wherein the actuator is controlled by a control amount signal that is obtained by adding together at least the position control signal and the velocity control
10 signal.

44. A disk drive apparatus comprising:

a disk-shaped information recording medium containing at least servo information;

15 a rotation control mechanism for rotating the information recording medium;

a head for at least reading information from the information recording medium; and

a head positioning system for positioning the head to a target head position
20 on the information recording medium,

wherein the head positioning system includes:

an actuator including a voice coil motor for moving the head;

a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the
25 head and a target head position signal which indicates the target head position, generating a

position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

5 a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal, and estimating the position of the head by integrating the estimated head velocity signal to output an estimated head position signal;

10 an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on a difference between the head position signal and the estimated head position signal to output a corrected estimated velocity signal; and

an estimation controller for outputting a velocity control signal based on the corrected estimated velocity signal,

15 wherein the actuator is controlled by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

45. A disk drive apparatus comprising:

20 a disk-shaped information recording medium containing at least servo information;

a rotation control mechanism for rotating the information recording medium;

a head for at least reading information from the information recording medium; and

25 a head positioning system for positioning the head to a target head position

on the information recording medium,

wherein the head positioning system includes:

an actuator including a voice coil motor for moving the head;

5 a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, generating a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

10 a velocity detector for receiving the head position signal, and detecting or estimating a relative velocity of the head with respect to the information recording medium to output a relative velocity signal that indicates a relative velocity of the head;

15 a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

20 an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal;

an estimated velocity signal switch for receiving the estimated head velocity signal and the corrected estimated velocity signal, and selectively outputting any one of the estimated head velocity signal and the corrected estimated velocity signal as a velocity signal; and

25 an estimation controller for outputting a velocity control signal

based on the velocity signal from the estimated velocity signal switch,

wherein the actuator is controlled by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

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46. A disk drive apparatus comprising:

a disk-shaped information recording medium containing at least servo information;

10 a rotation control mechanism for rotating the information recording medium;

a head for at least reading information from the information recording medium; and

a head positioning system for positioning the head to a target head position on the information recording medium,

15 wherein the head positioning system includes:

an actuator including a voice coil motor for moving the head;

a velocity detector for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head, and detecting or estimating a relative velocity of the head with respect to the
20 information recording medium to output a relative velocity signal that indicates a relative velocity of the head;

a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an
25 estimated head velocity signal, and estimating the position of the head by integrating the

estimated head velocity signal to output an estimated head position signal;

an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal;

5 an estimated position corrector for correcting an estimation error of the estimated head position signal based on a difference between the head position signal and the estimated head position signal to output a corrected estimated head position signal; and;

an estimation controller for generating a position control signal and
10 a velocity control signal based on the corrected estimated velocity signal and the corrected estimated head position signal,

wherein the actuator is controlled by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

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47. A disk drive apparatus comprising:

a disk-shaped information recording medium containing at least servo information;

a rotation control mechanism for rotating the information recording
20 medium;

a head for at least reading information from the information recording medium; and

a head positioning system for positioning the head to a target head position on the information recording medium,

25 wherein the head positioning system includes:

an actuator including a voice coil motor for moving the head;

a position controller for receiving a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, generating a position error signal that is a difference between the head position signal and the target head position signal, outputting a position control signal based on the position error signal, and outputting a position error integration control signal obtained by integrating the position error signal;

a velocity detector for receiving the head position signal, and detecting or estimating a relative velocity of the head with respect to the information recording medium to output a relative velocity signal that indicates a relative velocity of the head;

a counter electromotive voltage detector for detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

an estimated velocity corrector for correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal; and

an estimation controller for outputting a velocity control signal based on the corrected estimated velocity signal,

wherein the actuator is controlled by a control amount signal that is obtained by adding together the position control signal, the position error integration control signal and the velocity control signal.

48. A head positioning method for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo information, to a target head position on the information recording medium using an actuator including a voice coil motor for moving the head, the head positioning method
5 comprising the steps of:

generating, from a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, a position error signal that is a difference between the head position signal and the target head position signal, and
10 outputting a position control signal based on the position error signal;

detecting or estimating a relative velocity of the head with respect to the information recording medium based on the head position signal to output a relative velocity signal that indicates a relative velocity of the head;

detecting a counter electromotive voltage signal of the voice coil motor of
15 the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal;

outputting a velocity control signal based on the corrected estimated
20 velocity signal; and

controlling the actuator by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

49. A head positioning method for positioning a head, which at least reads information
25 from a rotating disk-shaped information recording medium containing at least servo

information, to a target head position on the information recording medium using an actuator including a voice coil motor for moving the head, the head positioning method comprising the steps of:

generating, from a head position signal which is generated by reading the
5 servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

detecting a relative velocity of the head with respect to the information
10 recording medium and estimating the relative head velocity based on the head position signal to output a detected velocity signal that indicates a detected value of the relative head velocity and an estimated velocity signal that indicates an estimated value of the relative head velocity;

selectively outputting any one of the detected velocity signal and the
15 estimated velocity signal as a relative velocity signal;

detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

correcting an estimation error of the estimated head velocity signal based on
20 the relative velocity signal to output a corrected estimated velocity signal;

outputting a velocity control signal based on the corrected estimated velocity signal; and

controlling the actuator by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

50. A head positioning method for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo information, to a target head position on the information recording medium using an actuator including a voice coil motor for moving the head, the head positioning method
5 comprising the steps of:

generating, from a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, a position error signal that is a difference between the head position signal and the target head position signal, and
10 outputting a position control signal based on the position error signal;

detecting a counter electromotive voltage signal of the voice coil motor of the actuator, estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal, and estimating the position of the head by integrating the estimated head velocity signal to output an estimated head
15 position signal;

correcting an estimation error of the estimated head velocity signal based on a difference between the head position signal and the estimated head position signal to output a corrected estimated velocity signal;

outputting a velocity control signal based on the corrected estimated
20 velocity signal; and

controlling the actuator by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

51. A head positioning method for positioning a head, which at least reads information
25 from a rotating disk-shaped information recording medium containing at least servo

information, to a target head position on the information recording medium using an actuator including a voice coil motor for moving the head, the head positioning method comprising the steps of:

generating, from a head position signal which is generated by reading the
5 servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, a position error signal that is a difference between the head position signal and the target head position signal, and outputting a position control signal based on the position error signal;

detecting or estimating a relative velocity of the head with respect to the
10 information recording medium based on the head position signal to output a relative velocity signal that indicates a relative velocity of the head;

detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

15 correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal;

selectively outputting any one of the estimated head velocity signal and the corrected estimated velocity signal as a velocity signal;

outputting a velocity control signal based on the velocity signal; and

20 controlling the actuator by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

52. A head positioning method for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo
25 information, to a target head position on the information recording medium using an

actuator including a voice coil motor for moving the head, the head positioning method comprising the steps of:

detecting or estimating, based on a head position signal which is generated by reading the servo information with the head and indicates the position of the head, a
5 relative velocity of the head with respect to the information recording medium to output a relative velocity signal that indicates a relative velocity of the head;

detecting a counter electromotive voltage signal of the voice coil motor of the actuator, estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal, and estimating the position of
10 the head by integrating the estimated head velocity signal to output an estimated head position signal;

correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal;

correcting an estimation error of the estimated head position signal based on
15 a difference between the head position signal and the estimated head position signal to output a corrected estimated head position signal;

generating a position control signal and a velocity control signal based on the corrected estimated velocity signal and the corrected estimated head position signal;
and

20 controlling the actuator by a control amount signal that is obtained by adding together at least the position control signal and the velocity control signal.

53. A head positioning method for positioning a head, which at least reads information from a rotating disk-shaped information recording medium containing at least servo
25 information, to a target head position on the information recording medium using an

actuator including a voice coil motor for moving the head, the head positioning method comprising the steps of:

generating, from a head position signal which is generated by reading the servo information with the head and indicates the position of the head and a target head position signal which indicates the target head position, a position error signal that is a difference between the head position signal and the target head position signal, outputting a position control signal based on the position error signal, and outputting a position error integration control signal obtained by integrating the position error signal;

detecting or estimating a relative velocity of the head with respect to the information recording medium based on the head position signal to output a relative velocity signal that indicates a relative velocity of the head;

detecting a counter electromotive voltage signal of the voice coil motor of the actuator, and estimating an absolute velocity of the head based on the counter electromotive voltage signal to output an estimated head velocity signal;

correcting an estimation error of the estimated head velocity signal based on the relative velocity signal to output a corrected estimated velocity signal;

outputting a velocity control signal based on the corrected estimated velocity signal; and

controlling the actuator by a control amount signal that is obtained by adding together the position control signal, the position error integration control signal and the velocity control signal.